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1981

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Recommended Citation

South Dakota State University, Cooperative Extension, "Grain Drying Programs on AGNET" (1981). *SDSU Extension Fact Sheets*. 937.

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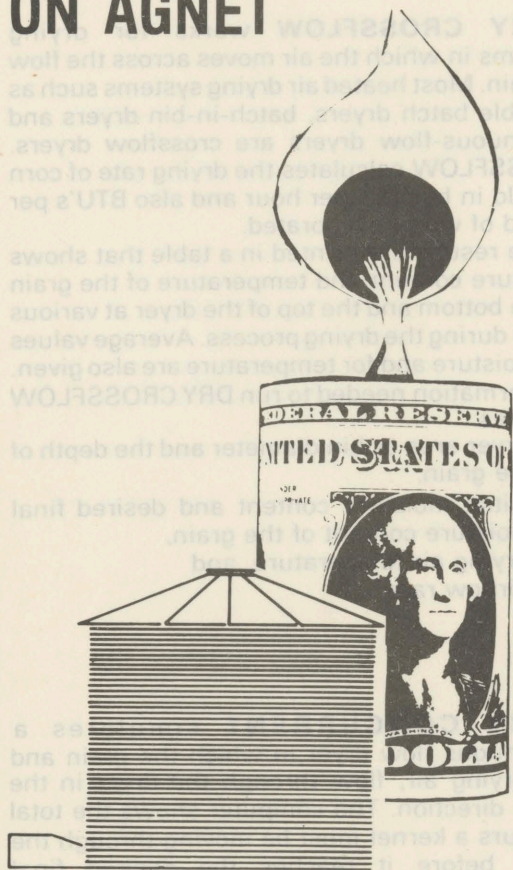
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GRAIN DRYING PROGRAMS ON AGNET



SOUTH DAKOTA

OFFICE OF ENERGY POLICY

CONTRACTOR:
COOPERATIVE EXTENSION SERVICE
SOUTH DAKOTA STATE UNIVERSITY

Grain drying programs on the AGNET computer system can help farmers decide the best type of drying equipment to use in their operation. AGNET will also help them adjust their management to use the drying system to the greatest advantage.

AGNET is an acronym for Agricultural computer NETwork. It was developed and is led by Dr. James G. Kendrick, Professor of Agricultural Economics and Dr. Thomas L. Thompson, Professor of Agricultural Engineering at the University of Nebraska, Lincoln. The system is designed to be used by people with no previous knowledge of computers.

Access to AGNET is through typewriter-like devices called terminals that "talk" to the computer over any standard telephone. The lightweight portable terminal can be used wherever there is an electric outlet and a phone.

The grain drying programs on AGNET have been developed by specialists at the University of Nebraska. Specialists in each of the seven partner states in the AGNET system can develop their own programs or have those already on the system modified to fit the specific weather conditions of their state. Programs are continually updated to keep them current with price changes and new research results.

Even individuals who have limited experience with grain drying can benefit from using AGNET grain drying programs. The user types a one-word program title, the computer then leads him through the program by asking questions about his specific system. If some terms are unfamiliar or the question is difficult to understand the user may type "Help" and the computer will explain the question in more detail.

The power of AGNET lies in the ability of the user to ask "what if" questions. The operator can explore management alternatives easily before investing in equipment or damaging any grain. Some examples would be: What if I raise the drying temperature 5 degrees? What if I purchase Fan A rather than Fan B? What will be my grain conditions if I stop drying on December 1?

The grain drying programs use mathematical simulations based on research results to predict how grain will dry. The computer shows on paper what will actually happen if the drying system operates as you say it will. A brief description of the grain drying programs now available on AGNET is given in the rest of this fact sheet.

BINDRY

The BINDRY Program simulates a bin drying system. It tells the user the moisture content and degree of spoilage of his corn.

Weather data from the National Weather Service is available for specific locations and is used to predict how the corn would have dried during any year for which the computer has data. Average weather data is also available.

The computer runs until all of the corn in the bin is below 15% moisture content. It shows the maximum, minimum and average moisture content of the grain on a daily or weekly schedule.

The computer printout then shows the total number of hours between loading the bin and the time the grain is dry. It also tells total hours the fan has run and energy used by the fan and heater to dry a bushel of corn. It prints out the number of BTU's needed to remove each pound of water.

Energy use is one way of comparing alternative methods of managing the drying system. Other AGNET Programs calculate energy used by batch drying systems. Comparing results from several programs allows the user to select the most energy efficient system for his farm.

BINDRY allows the user to evaluate high temperature, low temperature, and natural air drying systems. He can evaluate alternatives in fan operating schedule, bin and fan sizes, or any of the other information required by the computer. Information needed to run BINDRY includes:

- a) Bin diameter and number of bushels to be dried,
- b) The specific fan you will be using,
- c) Type of heat source, and automatic control settings,
- d) Fan operating schedule, if not continuous until dry,
- e) Stirring schedule if you have a stirring device,
- f) Schedule on loading the bin,
- g) Date of harvest and grain moisture content.

DRY

DRY is another program that simulates grain drying. Four different programs within DRY allow the user to evaluate drying with cross-flow, concurrent-flow, counter-flow and natural air dryers. All these types are commercially available.

DRY CROSSFLOW works for drying systems in which the air moves across the flow of grain. Most heated air drying systems such as portable batch dryers, batch-in-bin dryers and continuous-flow dryers are crossflow dryers. CROSSFLOW calculates the drying rate of corn or milo in bushels per hour and also BTU's per pound of water evaporated.

The results are printed in a table that shows moisture content and temperature of the grain at the bottom and the top of the dryer at various times during the drying process. Average values for moisture and for temperature are also given.

Information needed to run DRY CROSSFLOW includes:

- a) Dryer area or bin diameter and the depth of the grain,
- b) Initial moisture content and desired final moisture content of the grain,
- c) Drying air temperature, and
- d) Airflow rate.

DRY CONCURRENT simulates a continuous flow dryer in which the grain and the drying air, flow through the dryer in the same direction. The computer shows the total of hours a kernel must be moving through the dryer before it reaches the desired final moisture content. It also gives the number of bushels of grain dried per hour for each square foot of dryer area (The computer calls it GQ) and the BTU's used per pound of water evaporated.

Information needed before running DRY CONCURRENT includes:

- a) Drying air temperature,
- b) Airflow rate,
- c) Depth of grain, and
- d) Moisture content of grain entering the dryer and desired final moisture content.

DRY COUNTERFLOW stimulates a continuous flow dryer in which the corn or milo and the air flow through the dryer in opposite directions. Bin drying systems in which an unloader removes a layer of grain from the bottom of a bin while drying continues are one type of counter-flow dryer.

Information needed by the computer is the same as that for the concurrent flow dryer. The output is also similar in that it shows the bushels dried per hour for each square foot of dryer and the BTU's required to remove a pound of water. Other information printed out in a table shows the temperature and moisture content of grain at various places in the dryer.

DRY NATURAL simulates bin drying of corn or milo with ambient air. Ambient air drying is a slow process that is very energy efficient. Natural air drying can also be examined with the BINDRY program. BINDRY may give more satisfactory results as it uses actual weather service temperatures while DRY NATURAL operates with a constant temperature and relative humidity.

This program prints out a table showing moisture content and temperature of grain at the top and bottom of the bin. It also shows average temperature and moisture content conditions for the bin. It gives an indication of grain spoilage for several time periods after the dryer is started.

Several options are available in NATURAL that are not available in the BINDRY Program. When the grain temperature is over 20 degrees above ambient air temperature the system operates until the grain is cooled to within 10 degrees of the air. This option is useful when loading a bin with hot grain from a dryer. It tells how long to run fans to cool the grain. After it has cooled, aeration fans can be used to maintain the grain.

interval
A second option in DRY NATURAL allows you to set the computer to print out results on a fixed time ~~interval~~. Time required for grain cooling using aeration fans can thus be evaluated. The fixed option also allows you to specify moisture content and temperature of 10 layers of grain in the bin. It allows much more flexibility in running the program and in the form of the output.

Information needed to run DRY NATURAL includes:

- a) Air temperature and relative humidity,
- b) Grain temperature,
- c) Initial and desired final grain moisture contents,
- d) Airflow rate per bushel (can be determined in the program if desired).

DUCTLOCATION

DUCTLOCATION is a program that determines the number, size, and location of aeration ducts in a flat storage building. Either fullround, or flush mounted flat ducts can be selected.

The program can be used to evaluate an existing setup to see if aeration is adequate. When evaluating a system the information needed includes:

- a) Type of grain,
- b) Grain depth at sidewall and center of bin;
- c) Building dimensions,
- d) Type of duct (tubes or flush), and
- e) Number of ducts used, size and location.

In a new setup the computer selects duct size and location so that the air distribution is as good as possible. It selects enough ducts so that the ratio of the longest air flow path to the shortest air flow path is less than 1.5. Duct velocities are kept within recommendations when selecting duct sizes. For a new setup the information needed includes:

- a) Type of grain,
- b) Grain depth at sidewall and center of bin,
- c) Building dimensions,
- d) Air flow rate desired,
- e) Type (Tube or Flush) and number of ducts desired,
- f) Sizes of ducts available.

FAN

The FAN Program has two sub-programs, FANSIZE and FANMATCH.

FANSIZE estimates the fan characteristics needed to fit your aeration or drying bin. It shows static pressures developed, total airflow rates and the horsepower needed to run the fan. Based on that information the user can start shopping for a specific fan for his bin. Information needed to run FANSIZE includes:

- a) Dimensions of ductwork you will be using.
- b) Type of grain in the bin, and
- c) Bin diameter and depth of grain.

FANMATCH matches the specific characteristics of the fan you select to the characteristics of your grain drying system. It generates a table showing air flow rates, static pressures and power requirements for various depths of grain. Fan characteristic curves, based on advertised cubic feet per minute vs. static pressure ratings, are available for over 150 fans. The program authors keep the list of fans current with what is available from the fan industry.

Several options are available when running FANMATCH. If the user has the characteristics for a fan that is not on the system he can enter that data and use it in the analysis. Combinations of fans can be entered if that is what the user has on the bin. Information needed before running the FANMATCH Program include:

- a) Fan identification information (Manufacturer, size, etc..)
- b) Sizes and lengths of the ductwork,
- c) The type of grain in the bin, and
- d) The bin diameter and depth of grain it contains.